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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/842,802	04/27/2001	Takao Noguchi	206645US0	2819

22850 7590 11/29/2005

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EXAMINER	
SONG, MATTHEW J	

ART UNIT	PAPER NUMBER
1722	

DATE MAILED: 11/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/842,802	Applicant(s) NOGUCHI ET AL.
	Examiner Matthew J. Song	Art Unit 1722

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 September 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2 and 5-9* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2 and 5-9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

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Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 9/9/2005 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35-U.S.C. 103(a).

3. Claims 1, 2 and 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yano et al (US 5,801,105) in view of Tarui et al (US 5,674,563).

In a method of growing epitaxial perovskite films, note entire reference, Yano et al discloses a multilayer thin film of $BaTiO_3$ (001)/Pt (001)/$BaTiO_3$ (001)/ ZrO_2 (001)/Si (100), note column 28, lines 54-67. The ZrO_2 (001) layer reads on applicant's buffer layer of an oxide thin film of zirconium or of a rare earth element. Yano et al also discloses tungsten bronze type compounds and the perovskite compounds used are $BaTiO_3$, $SrTiO_3$, PLZT, PZT, $CaTiO_3$ and $PbTiO_3$ (col 12, ln 15-55). Yano et al also discloses the substrate can be gallium arsenide and Si (100) (col 12, ln 55-65). Yano et al also discloses a perovskite/film composed of zirconium oxide stabilized with rare earth metal element/silicon structure is effective for improving the crystallinity of an oriented film formed thereon, for example, films of ferroelectric materials and electrode films of Pt (col 14, ln 20-35). Yano et al teaches forming an epitaxial perovskite oxide film of (001) on a platinum epitaxial film, this reads on applicants' epitaxially grown second perovskite oxide having an (001) orientation. Yano et al also teaches a metal electrode or conductive epitaxial film of Pt is preferably of (001) or (100) oriented crystal and preferably an epitaxial film (col 19, ln 1-40).

Yano et al does not teach the ferroelectric film is not the second perovskite oxide thin film that is grown on the second perovskite oxide thin film.

In a method of forming a ferroelectric thin film, note entire reference, Tarui et al teaches forming PZT on a Pt substrate using a $PbTiO_3$ buffer layer to improve the flatness of the PZT ferroelectric thin film (col 17, ln 1-25 and col 5, ln 35-67). Tarui et al also teaches the ferroelectric film was a c-axis orientation film exhibiting PZT (001) and is an epitaxial film (col

16, ln 1-40). Tarui et al is silent to the orientation of the orientation of the $PbTiO_3$ layer. The $PbTiO_3$ layer inherently has an (001) orientation because by the definition of epitaxy, the epitaxial PZT (001) mimics the orientation of the substrate it is formed on. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Yano et al by using a $PbTiO_3$ buffer between Pt and PZT to improve the flatness of a PZT layer, as taught by Tarui et al.

Referring to claim 1, the combination of Yano et al and Tarui et al does not teach a ferroelectric film having (100) and (001) orientation, however this feature is inherent to the combination of Yano et al and Tarui et al because the combination of Yano et al and Tarui et al teaches forming the ferroelectric film over a Si substrate, as applicants. Applicants teach a ferroelectric film may have a 90° domain structure comprising (100) and (001) oriented crystals under the influence of stresses from the Si substrate. Therefore, the ferroelectric film taught by the combination of Yano et al and Tarui et al is expected to have (100) and (001) oriented crystals because the crystals would be influenced by the Si substrate in a similar manner, as taught by applicant.

Referring to claim 2, the combination of Yano et al and Tarui et al is silent to the perovskite has insulating properties, however this is inherent to the combination of Yano et al and Tarui et al because the combination of Yano et al and Tarui et al teaches a similar material as applicant, therefore a similar material will inherently have similar properties.

Referring to claim 5, the combination of Yano et al and Tarui et al teaches tungsten bronze type compounds and the perovskite compounds used are $BaTiO_3$, $SrTiO_3$, PLZT, PZT, $CaTiO_3$ and $PbTiO_3$ (col 12, ln 15-55).

Referring to claim 6, the combination of Yano et al and Tarui et al teaches fabricating electronic devices, such as volatile memories, infrared sensors, optical modulators and superconducting sensors (Yano col 29, ln 25-50).

4. Claims 1, 2 and 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yano et al (JP 10-017394), where US 6,121,647 is used as an accurate translation of JP 10-017394, in view of Tarui et al (US 5,674,563).

In a method of growing epitaxial perovskite films, note entire reference, Yano et al teaches a single crystal silicon substrate, a ZrO_2 thin film (intermediate thin film), a $BaTiO_3$ film (insulative subbing thin film), a Pt film and a ferroelectric thin film were formed in the described order ('647 col 26, ln 40-60). The ZrO_2 thin film reads on applicants buffer layer, the $BaTiO_3$ reads on applicant's Perovskite layer and the Pt layer reads on applicants electrically conductive layer. Yano et al also discloses the insulative subbing layer has perovskite crystal structure of ABO_3, where A is Pb and B is Ti; this reads on applicant's $PbTiO_3$. Yano et al also discloses the insulative subbing thin film has a (001) or (100) unidirectional orientation ('647 col 10, ln 15-55. Yano et al also discloses the zirconium oxide thin film is composed mainly of zirconium oxide or zirconium oxide stabilized with a rare earth metal ('647 col 45-67). Yano et al also discloses a silicon substrate with a (100) orientation ('647 col 9, ln 60 to col 10, ln 15). Yano et al also discloses the film structure can form electronic devices ('647 col 16, ln 5-20). Yano et al also discloses in the ferroelectric thin film of $PbTiO_3$, where part of Ti may be replaced by at least Zr ('647 col 9, ln 55-65 and col 8, ln 10-67), this reads on applicant's PZT. Yano et al teaches forming a perovskite oxide film of (001) orientation ('647 Abstract), this reads on applicants'

second perovskite oxide having a (001) orientation. Yano et al also discloses the ferroelectric film is preferably a (001) oriented film and most preferably an epitaxial film (col 8, ln 5-67). Yano et al also discloses the conductive subbing film of Pt has a (001) orientation and is most preferably an epitaxial film (col 11, ln 1-35).

Yano et al does not teach the ferroelectric film is not the second perovskite oxide thin film that is grown on the second perovskite oxide thin film.

In a method of forming a ferroelectric thin film, note entire reference, Tarui et al teaches forming PZT on a Pt substrate using a $PbTiO_3$ buffer layer to improve the flatness of the PZT ferroelectric thin film (col 17, ln 1-25 and col 5, ln 35-67). Tarui et al also teaches the ferroelectric film was a c-axis orientation film exhibiting PZT (001) and is an epitaxial film (col 16, ln 1-40). Tarui et al is silent to the orientation of the orientation of the $PbTiO_3$ layer. The $PbTiO_3$ layer inherently has a (001) orientation because by the definition of epitaxy, the epitaxial PZT (001) mimics the orientation of the substrate it is formed on. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Yano et al by using a $PbTiO_3$ buffer between Pt and PZT to improve the flatness of a PZT layer, as taught by Tarui et al.

Referring to claim 1, the combination of Yano et al and Tarui et al does not teach a ferroelectric film having (100) and (001) orientation, however this feature is inherent to the combination of Yano et al and Tarui et al because the combination of Yano et al and Tarui et al teaches forming the ferroelectric film over a Si substrate, as applicants. Applicants teach a ferroelectric film may have a 90° domain structure comprising (100) and (001) oriented crystals under the influence of stresses from the Si substrate. Therefore, the ferroelectric film taught by

the combination of Yano et al and Tarui et al is expected to have (100) and (001) oriented crystals because the crystals would be influenced by the Si substrate in a similar manner, as taught by applicant.

5. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yano et al (US 5,801,105) or Yano et al (JP 10-017394), where US 6,121,647 is used as an accurate translation of JP 10-017394; in view of Tarui et al (US 5,674,563), as applied to claims 1,2 and 4-8 above, and further in view of Moon (US 5,744,374) or Nashimoto (US 5,834,803).

The combination of Yano ('105) and Tarui et al or the combination of Yano et al ('394) and Tarui et al teaches all of the limitations of claim 9 including a ZrO_2 layer on a silicon substrate, as discussed previously, except the buffer layer comprises Y_2O_3.

In a method of forming a ferroelectric film, note entire reference, Moon teaches a silicon substrate and a yttrium oxide (Y_2O_3) film over the substrate and a ferroelectric film formed over the yttrium oxide layer (col 4, ln 40-55). Moon also teaches when a PT ($PbTiO_3$) ferroelectric film is formed on the yttrium oxide film it is possible to form a good quality ferroelectric film can be formed on a silicon semiconductor substrate (col 4, ln 1-15 and col 5, ln 1-5). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Yano ('105) and Tarui et al or the combination of Yano et al ('394) and Tarui et al with Moon's yttrium layer between a silicon substrate and a PT layer to form a good quality film.

In a method of forming a ferroelectric film, note entire reference, Nashimoto teaches a single crystal substrate 1 of silicon (100) (col 3, ln 65 to col 4, ln 5 and col 10, ln 20-35), an

epitaxial buffer layer **5** of MgO, ZrO_2 or Y_2O_3 (col 4, ln 10-15), a first ferroelectric thin film layer **2** and a second ferroelectric thin film layer **3**, thereon. Nashimoto also teaches the first and second ferroelectric thin films include ABO_3 type ferroelectric substances such as $LiNbO_3$, PZT, $BaTiO_3$ and $PbTiO_3$ (col 4, ln 16-67 and col 10, ln 35-40). Nashimoto also teaches a $PbTiO_3$ (001) film grown on a buffer and the $PbTiO_3$ is a perovskite (col 10, ln 41-67). Nashimoto also teaches the first and second ferroelectric thin films may be formed from different ferroelectric substances (col 4, ln 55-60). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Yano ('105) and Tarui et al or the combination of Yano et al ('394) and Tarui et al ZrO_2 layer by substituting Nashimoto's Y_2O_3 layer because substitution of known equivalents for the same purpose is held to be obvious. (MPEP 2144.06).

Response to Arguments

6. Applicant's arguments with respect to claims 1-2 and 5-9 have been considered but are moot in view of the new ground(s) of rejection.

7. Applicant's arguments filed 9/9/2005 have been fully considered but they are not persuasive.

The combination of Yano and Tarui does not teach a (100) and (001) oriented ferroelectric film, however the feature is expected to be inherent because applicant's teach the (100) and (001) oriented crystals are formed because of the stresses caused by the Si substrate and the combination of Yano and Tarui teach using a Si substrate; therefore the stresses caused by the substrate on the ferroelectric film are expected to produce similar effects.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1722

MJS
11/26/05

ROBERT KUNEMUND
PRIMARY EXAMINER